



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(21) International Application Number:</b> PCT/US89/03313 <b>(22) International Filing Date:</b> 1 August 1989 (01.08.89)  <b>(30) Priority data:</b> 331,695 31 March 1989 (31.03.89) US  <b>(71) Applicant:</b> ECOLAB INC. [US/US]; 370 North Wabasha Street, St. Paul, MN 55102 (US).  <b>(72) Inventors:</b> BULL, Sandra, L. ; 1254 Wilderness Curve, Eagan, MN 55123 (US). GLADFELTER, Elizabeth, J. ; 1574 Arona Street, Falcon Heights, MN 55113 (US). OLSON, Keith, E. ; 13952 Eveleth Court, Apple Valley, MN 55124 (US).		<b>(74) Agents:</b> BYRNE, Linda, M. et al.; 1000 Norwest Center, 55 East Fifth Street, St. Paul, MN 55101 (US).  <b>(81) Designated States:</b> AT (European patent), AU, BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent).  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> CAST DETERGENT SYSTEMS  <b>(57) Abstract</b>  A general purpose detergent system and detergent system useful in warewashing and in laundry processes have been developed in which highly active encapsulated halogen sources have been incorporated into cast, solid detergent systems containing oxidizable organics that are highly reactive with the active chlorine sources. The stability of the detergent systems thus formulated has been shown to be sufficient to permit the cast materials to be storage stable for a sufficient period to permit the manufacture, distribution, sale and consumption of the cast materials before the availability of either the organic materials or the active halogen drops below an effective level.		

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CAST DETERSIVE SYSTEMS.Field of the Invention

The invention relates to a deterative system containing  
5 soil removing detergents, an encapsulated halogen source  
and an organic component such as a polyalkylene oxide  
polymer, and to the use of the system in cleaning. More  
specifically the deterative systems of the invention can  
contain an active encapsulated halogen source and organic  
10 component, preferably an alkylene oxide polymer, which are  
co-stable at relatively high concentration during  
manufacture, storage, distribution, sale and use. Such  
deterative systems can be used in a variety of environments  
including general purpose cleaning, laundry, warewashing,  
15 etc., while producing an effective concentration of active  
chlorine for stain removal and sanitizing purposes in the  
presence of organic materials such as defoamers, soil  
removing nonionic surfactants and other polyalkylene oxide  
polymers.

20

Background of the Invention

Deterative systems have been used for many years in  
cleaning environments such as laundry, warewashing, hard  
surface cleaning and other general cleaning applications.  
Typically deterative systems are concentrates comprising  
25 mixtures of cleaning ingredients that, just prior to use,  
are mixed with water to form a cleaning medium or final use  
composition.

Many deterative systems contain organic materials that  
function in a variety of modes. Such organics can act as  
30 defoaming agents, dispersing agents, soil removing  
surfactants, thickening agents, casting aids, anti-  
redeposition aids, viscosity modifiers, brightening agents,  
etc. One important class of organic materials is  
polyalkylene oxide polymers. The polyalkylene oxide  
35 polymers derive their properties from the presence of large  
polymeric units derived from ethylene oxide, propylene  
oxide, heteric polymers thereof or block copolymers

thereof.

In a variety of use environments for such deter-  
sive systems, the presence of oxidizing available halogen such  
as chlorine or bromine can be important. Such halogen  
5 compounds can clean and remove certain residues, and can  
remove stains by oxidizing and destroying color generating  
functional groups in organic molecules. Further, the  
presence of sufficient concentrations of active chlorine  
can kill microorganisms and provide an antimicrobial or  
10 sanitizing action. However, deter- sive systems  
manufacturers have been reluctant to produce deter- sive  
systems in which organic materials such as polyalkylene  
oxide polymers and active chlorine yielding substances come  
into direct contact. Such contact can have undesirable  
15 safety and performance consequences.

In the manufacture of a variety of deter- sive systems,  
contacting many organic substances with active chlorine  
compounds is hazardous. At elevated temperatures or at  
high concentrations, contacting such organic compounds with  
20 active chlorine-yielding substances can result in a rapid  
reaction between the chlorine substances and the organic  
materials resulting in the production of large volumes of  
smoke or fire. If the deter- sive systems are successfully  
manufactured without rapid reaction between the chlorine  
25 and polyalkylene oxide components, the materials during  
manufacture, packaging, storage, distribution, sale and use  
can slowly react causing a significant depletion in the  
concentration of both the organic materials and the active  
chlorine substance. Such reactions commonly occur at a  
30 rate such that the concentration of active chlorine in the  
deter- sive system is below the concentration necessary for  
sanitizing properties and even is often below the  
concentration required for stain removal. Further such  
reactions can reduce the concentration of the organic  
35 materials to a level that results in substantially reducing  
the level of properties derived from the polymer.

We have found that active halogen can be lost through

a spontaneous degradation of active chlorine and by reactivity of chlorine with functional groups commonly found in organics used in deterative systems. The common functional groups reactive with active chlorine compounds include olefinic bonds commonly found in unsaturated fatty acids which are a common composition of alkali metal soaps, hydroxyl groups typically found in organic builders, amine groups, ether groups common in polyalkylene oxide polymers and aromatic rings typically found in alkyl benzene sulfonates, alkyl phenol ethoxylates, etc. The prior art commonly kept the concentration of organics less than 5 wt-% to reduce the harmful effects of the organic/chlorine interaction.

Accordingly a substantial need exists in the art for deterative systems containing significant effective concentrations (greater than 5 wt-%) of organic materials in the form of surfactants, foam suppressing agents and other functional materials, and containing effective concentrations (greater than 5 wt-%) of active chlorine from chlorine yielding compounds.

#### Brief Description of the Invention

We have found that a cast, solid deterative system containing an effective amount of a source of alkalinity, an effective hardness sequestering agent, at least 5 wt-% of an encapsulated source of chlorine and at least 5 wt-% of an organic such as polyalkylene oxide polymer is an effective deterative system that can be used in general purpose cleaning, laundry, warewashing, hard surface cleaning and sanitizing, and a variety of other end uses. We have surprisingly found that such materials when cast in a solid form result in substantial stability of an effective concentration of both chlorine and organic materials during manufacture, storage, distribution and use. We have found that for periods typical in the lifetime of such a product, the products can maintain a substantial concentration of active chlorine and an effective concentration of organics until the product is

entirely consumed.

#### Detailed Discussion of the Invention

The deterative systems of the invention can comprise an effective amount of a source of alkalinity, an effective  
5 amount of a hardness sequestering agent, at least 5 wt-%, up to about 50 wt-%, of an encapsulated source of chlorine compound, and at least 5 wt-%, up to about 50 wt-%, of an organic composition such as a polyalkylene oxide polymer. The deterative systems of this invention are typically in  
10 the form of a cast, solid material wherein the material is in the form of a large, solid mass having a minimum weight of about 50 grams held within a disposable container. The deterative system or concentrate can be dispensed from the container or can be removed from its container and placed  
15 into the dispenser for dilution and use at the use site.

#### Inorganic Source of Alkalinity

The deterative systems of the invention can contain an inorganic source of alkalinity. Sources of alkalinity identified as being useful in combination with the other  
20 components of the deterative systems of the invention include but are not limited to the following: alkali metal hydroxide, alkali metal phosphate, alkali metal carbonate, alkali metal bicarbonate, alkali metal sequeicarbonate, alkali metal borate, alkali metal silicate, and mixtures  
25 thereof. Alkali metal hydroxides are typically used where the deterative system requires strong cleaning action and highest pH. Silicates ( $M_2O:SiO_2$  compounds having a ratio from about 2:1 to 1:3.6 wherein M is an alkali metal ion) are typically a reaction product between an alkali metal  
30 hydroxide and silica. Such silicates are primarily used as a source of alkalinity where moderate strength and pH are required. Carbonate and borate sources of alkalinity are typically used in compositions having an alkaline pH but do not require the strength of alkalinity of silicates or  
35 hydroxides.

#### Hardness Sequestering Agents

The deterative systems of the invention typically

contain a hardness sequestering agent to reduce the harmful effects of divalent and trivalent metal ions on the components of the deterative systems. The deterative systems of the invention can contain both organic and inorganic  
5 hardness sequestering agents. Such sequestering agents are typically in the form of polyanionic materials.

Inorganic hardness sequestering agents include alkali metal condensed phosphates in the form of pyrophosphate, tripolyphosphate, hexametaphosphate, etc. Organic hardness  
10 sequestering agents include polymeric and copolymeric compositions having pendent carboxylic acid functionality derived from carboxylic acid containing monomers such as acrylic acid, methacrylic acid, maleic acid, itaconic acid, fumaric acid and mixtures thereof, etc.; alkali metal salts  
15 of organic substituted phosphonic acid and polyphosphonic acids, alkali metal salts of gluconic acid, alkali metal salts of ethylene diamine tetraacetic acid, alkali metal salts of nitrilotriacetic acid, and mixtures thereof.

#### Organic Materials

20 A variety of organic functional materials can be used in the deterative systems of the invention. Such functional materials include absorbents, adsorbents, antimicrobials, antioxidants, anti-soil agents, perfumes, dyes, binders, chelating agents, corrosion inhibitors, coupling agents,  
25 defoamers, dispersants, solubilizers, stabilizers, thickeners, and UV absorbers. Examples of such absorbents and adsorbents are microcrystalline cellulose, zinc ricinoleate, free-flowing malto dextrin, powdered acrylate copolymers, and others. Anti-soil or anti-soil  
30 redeposition agents that can be used include fatty acid amides, fluorocarbon surfactants, complex phosphate esters, styrene maleic anhydride copolymers, and cellulosic derivatives such as hydroxyethyl cellulose, hydroxypropyl cellulose, and others. Powder binders that can be used to  
35 aid in the formation of solid materials include microcrystalline cellulose, long chain lactate esters, long chain oleate esters, polyacrylamides, microcrystalline

waxes, polyvinyl alcohol resins, polyethylene, polyvinyl pyrrolidone, and others.

Defoamers that can be used in the deterative systems of the invention include high molecular weight  $C_{10-40}$  linear  
5 primary alcohols, polyalkylene glycols, well known silicone defoamers, certain acrylate copolymers, and others.

One important class of functional organic materials in the manufacture of deterative systems of the invention comprises organic surfactants. A wide variety of  
10 surfactants can be used in the deterative systems of the invention including anionic surfactants, zwitterionic surfactants (containing both anionic and cationic groups), cationic surfactants and nonionic surfactants. Anionic surfactants include alkyl carboxylate (sodium and potassium  
15 soaps), alkyl sulfate, alkyl ether sulfate, alkyl benzene sulfonate, alkyl sulfonate, sulfonated fatty acid ester, sulfosuccinate surfactant.

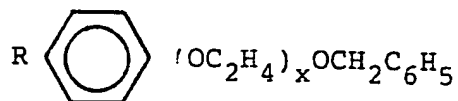
Nonionic surfactants typically in the form of compositions having polyalkylene oxide polymers as a  
20 portion of the surfactant molecule can be useful in the deterative systems of the invention.

Nonionic surfactants which are advantageously employed in the composition of this invention include, but are not limited to, the following polyoxyalkylene nonionic  
25 detergents:  $C_8-C_{22}$  normal fatty alcohol-ethylene oxide or propylene oxide condensates, i.e., condensation products of one mole of a fatty alcohol containing 8 to 22 carbon atoms with from 2 to 20 moles of ethylene oxide or propylene oxide; polyoxypropylene-polyoxyethylene condensates having  
30 the formula  $HO(C_2H_4O)_x(C_3H_6O)_y-H$  wherein  $(C_2H_4O)_x$  equals at least 15% and  $(C_3H_6O)_y$  equals 20-90% of the total weight of the compound; alkyl polyoxypropylenepolyoxyethylene condensates having the formula  $RO-(C_3H_6O)_x(C_2H_4O)_yH$  where R is a  $C_1-C_{15}$  alkyl group and x and y each represent an  
35 integer of from 2 to 98; polyoxyalkylene glycols as described in U.S. Pat. No. 3,048,548; butylene oxide capped alcohol ethoxylates having the formula  $R(OC_2H_4)_y(OC_4H_9)_xOH$



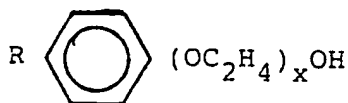
where R is a C<sub>8</sub>-C<sub>18</sub> alkyl group and y is from about 3.5 to 10 and x is an integer from about 0.5 to 1.5; benzyl ethers of polyoxyethylene condensates of alkyl phenols having the formula

5



10 where R is a C<sub>6</sub>-C<sub>20</sub> alkyl group and x is an integer of from 5 to 40; and alkyl phenoxy polyoxyethylene ethanols having the formula

15



where R is a C<sub>8</sub>-C<sub>20</sub> alkyl group and x is an integer of from 3 to 20.

20

#### Non-Surfactant Polyoxyalkylene Groups

Nonsurfactant polyalkylene oxide polymers are used in the manufacture of the deterative systems of the invention as a binder or as a casting agent in which the materials of the invention are blended with the casting agent at elevated temperatures and the cooling of the blended material solidifies the casting agent resulting in a stable cast solid. Such polyalkylene oxide polymers comprise homopolymers of ethylene oxide (EO), homopolymers of propylene oxide (PO), heteric EO/PO copolymers or block EO/PO copolymers, for example, those of molecular weight from 1,000 to 10,000, especially about 6,000 to 8,000. These materials are not to be considered as surfactant materials in the context of the present invention.

30

#### Additional Ingredients

35 The deterative systems of the invention can contain anti-foaming agents, typically in an amount of from about 0.001% to about 2%, preferably 0.05 to 1%. Such foam

suppressing or foam regulating agents include silicone compounds, phosphate esters, microcrystalline slack waxes, etc. In somewhat greater detail, preferred suds suppressing agents are silicone materials which are  
5 siloxanes having the formula



wherein X is from about 20 to about 2,000 and R and R' are each independently selected from the group consisting of  
15 C<sub>1-20</sub> alkyl or alkyl substituted aryl groups. Preferred groups include methyl, ethyl, propyl, butyl, and phenyl. Polydimethyl siloxanes having a molecular weight in the range of 200 to 200,000 and higher are useful suds controlling agents. Other suds suppressing agents include  
20 alkyl phosphate esters such as monostearyl phosphate and microcrystalline waxes having a melting point from about 65° C. to about 100° C. and having a molecular weight from 400 to about 1,000.

The deterative systems of the invention can contain  
25 neutral organic and inorganic fillers such as sodium sulfate and sodium chloride. Organic fillers that can be used in the invention include starch, sugars, alkylene glycols having from 1 to 10 carbon atoms, etc. Additionally the compositions can contain proteolytic and  
30 amylolytic enzymes, tarnish inhibitors such as benzo-triazol, antibacterial agents, anti-soil redeposition agents, soil suspending agents, dyes, perfumes, and silicate, glass and aluminum tarnish suppressing agents.

#### Method of Casting the Deterative Systems

35 The components of the deterative systems are typically cast in a disposable container which also acts as a mold. The deterative system can be dispensed from the container or can be removed from the container prior to insertion in the

dispenser. Alternatively the deterrent system components can be cast in a reusable mold wherein the cast material is removed from the mold and placed into a separate disposable container for shipment and use.

5       The deterrent system can be cast in virtually any order of addition of materials to a mixing unit. Once uniform the material for casting is then placed in an appropriate mold.

10       A preferred mode of casting the material is to place the low molecular weight and water soluble materials into a mixing chamber in conjunction with any water used in the manufacture of the materials. Next the higher molecular weight or insoluble materials are slowly added to the contents of the mixing unit until a uniform suspension is  
15       obtained. Lastly the active halogen source can be added to the mixture. The mixture is carefully agitated at a slow rate such that the integrity of the encapsulate is not compromised.

#### Encapsulate

20       The encapsulated sources of halogen of this invention comprise a core of an active halogen compound and at least one coating layer. Preferably the encapsulated sources of halogen have a core and two or more coating layers. If one layer is used it preferably comprises an inorganic coating  
25       of a composition compatible with the halogen source, however certain coatings of a synthetic detergent can be used. If two layers are used the first layer comprises a typically inert or inorganic coating agent and the second layer comprises an organic layer or a synthetic detergent  
30       layer.

#### Halogen Source

35       The halogen releasing substances suitable as a core material include halogen components capable of liberating active halogen species such as a free elemental halogen or -OX- wherein X is Cl or Br, under conditions normally used in detergent-bleaching cleaning processes. Preferably the halogen releasing compound releases chlorine or bromine

species. The most preferred halogen releasing compound releases chlorine. Chlorine releasing compounds include potassium dichloroisocyanurate, sodium dichloroisocyanurate, chlorinated trisodium phosphate, calcium hypochlorite, lithium hypochlorite, monochloroamine, dichloroamine, pentaisocyanurate, 1,3-dichloro-5,5-dimethylhydantoin, paratoluene sulfondichloro-amide, trichloromelamine, N-chloromelamine, N-chlorosuccinimide, N,N'-dichloroazodi-carbonamide, N-chloro-acetyl-urea, N,N-dichlorobiuret, chlorinated dicyandiamide, trichlorocyanuric acid, and dichloroglycoluril.

Sodium dichloroisocyanurate, potassium dichloroisocyanurate and the dihydrates thereof are the most preferred oxidizing chlorine source suitable as a core substance. These materials are commercially available and may be obtained from sources such as Monsanto or Olin Corp.

#### Coating Materials

The coating on the active halogen source can be a single or multiple layer coating. Single layer coatings can comprise virtually any inert organic or inorganic coating material stable with a halogen source that is solid at room temperature. In the instance that a multiple layer coating is used, often the first layer is an inorganic layer where the second layer comprises an organic layer that can be drawn from a variety of sources.

Nearly any substance may be employed as the first coating so long as it is substantially halogen inert and is a solid at normal storage temperatures typically between 30° and 100° F. (-1° to 38° C.). The coating material is preferably inert with respect to the core material. If the inner coating material is potentially reactive with the core material, the core material may be initially coated with an inert material to prevent or retard any reaction between the core and this first coat, the initial coat acting as a chemical barrier between the core and the first and other layers. Useful inorganics in the coating material include alkalis such as sodium carbonate, sodium

bicarbonate, sodium sequicarbonate, sodium borate, potassium bicarbonate, potassium sequicarbonate, potassium borate, phosphates such as diammonium phosphates, monocalcium phosphate, tricalcium phosphate, calcium  
5 pyrophosphate, iron pyrophosphate, magnesium phosphate, monopotassium orthophosphate, potassium pyrophosphate, disodium orthophosphate, trisodium orthophosphate, tetrasodium pyrophosphate, sodium tripolyphosphate, sodium phosphate glass; neutral salts such as zeolites, sodium  
10 sulfate, sodium chloride, and talc; silicates and silicate hydrates such as sodium metasilicate, sodium sequisilicate, dry sodium/potassium silicate water glasses, sodium orthosilicate and mixtures thereof.

A useful initial inorganic coating compound for a  
15 halogen bleach core material to be used in a detergent composition would be an admixture of sodium sulfate and sodium tripolyphosphate. Sodium sulfate and sodium tripolyphosphate are relatively inert with respect to halogen bleaches and are components commonly blended into  
20 detergent compositions.

#### Outer Coating Materials

Nearly any substance may be employed as the outer coating material so long as it is solid at normal storage temperatures (typically between 30° and 100° F.). A  
25 nonexhaustive list of compounds which may be used as the second coat includes alkalies such as sodium carbonate, sodium bicarbonate, sodium sequicarbonate, sodium borate, potassium bicarbonate, potassium sequicarbonate, potassium borate, sodium sulfate hydrate, phosphates such as  
30 diammonium phosphates, monocalcium phosphate, tricalcium phosphate, calcium pyrophosphate, iron pyrophosphate, magnesium phosphate, monopotassium orthophosphate, potassium pyrophosphate, disodium orthophosphate, trisodium orthophosphate, tetrasodium pyrophosphate, sodium  
35 tripolyphosphate, sodium phosphate glass; neutral salts such as zeolites, sodium sulfate, sodium chloride, and talc; silicates and silicate hydrates such as sodium

metasilicate, sodium sequisilicate, dry sodium/potassium silicate water glasses, sodium orthosilicate; organic sequestering agents such as copolymers of vinylacetate and maleic anhydride, copolymers of acrylic acid and maleic anhydride, copolymers of maleic anhydride and itaconic acid, polyacrylic acid; and N-alkyl sulfonate, such as octyl sulfonate, sodium carboxymethyl celluloses, hydropropyl cellulose, hydroxyethyl ether of cellulose, hydroxypropylmethyl cellulose; C<sub>12</sub> to C<sub>20</sub> fatty acids such as stearic acid, palmitic acid, and n-alkanoic acids; paraffin waxes; microcrystalline waxes; C<sub>12</sub> and greater primary and secondary solid alcohols; Pluronic surfactants with molecular weight between about 8,000 to about 16,500; primary and secondary alkyl sulfates; and alkali metal sulfonates and mixtures thereof. The preferred encapsulate uses an outer coating that is insoluble in the liquid composition prior to casting. After the detergent system is cast, the preferred encapsulates are water soluble to permit release of the halogen into the cleaning medium.

The synthetic detergent compound used in the coating must remain sufficiently solid at temperatures likely to be encountered during storage of the product, for example, temperatures of about 15 to 50° C., and also remain stable at temperatures likely to be encountered during processing of the product into end use mixtures, for example, temperatures of about 15 to 95° C.

Synthetic detergents that can be used include anionic, cationic, nonionic and amphoteric detergent compositions. Examples of anionic detergents useful in the detergent-bleach compositions of the invention are the higher alkyl mononuclear aromatic alkali-metal sulfates and sulfonates, and linear alkyl sulfates and sulfonates such as alkylbenzene sulfonates having about 9 to about 13 carbon atoms in the alkyl group wherein the alkyl group is derived from polypropylene as described by Lewis in U.S. Pat. No. 2,477,382, or wherein the alkyl group is a hexene dimer or trimer as in McEwan, U.S. Pat. No. 3,370,100, or wherein

the alkyl group is derived from alpha-olefins, as in Swenson, U.S. Pat. No. 3,214,462. Also there may be employed primary and secondary alkyl sulfates.

The soaps are included within the definition of anionic detergents as used herein. Examples of operable soaps soluble with the present invention are the sodium and potassium salts of acyclic monocarboxylic acids having chain lengths of about 8 to about 22 carbon atoms.

A particularly suitable synthetic detergent for use as a coating in the present invention is preoxidized sodium octyl sulfonate. The sodium octyl sulfonate may contain 1,2 alkane bisulfonate as a by-product of manufacture which does not affect the performance of sodium octyl sulfonate as a coating in the invention.

The organic compound coating is applied as a solution in a suitable solvent, water being preferred because of its compatibility with chlorine releasing agents, non-flammability, and non-toxicity.

The compositions of the present invention may be formulated with a detergent builder as a detergency aid, for example, those mentioned hereinafter, to provide a commercially valuable detergent-bleach composition.

Inorganic fillers suitable for coating agents include alkalies such as sodium bicarbonate, sodium sesquicarbonate, sodium borate, potassium bicarbonate, potassium sesquicarbonate, potassium borate; phosphates such as diammonium phosphate, monocalcium phosphate monohydrate, tricalcium phosphate, calcium pyrophosphate, iron pyrophosphate, magnesium phosphate, monopotassium orthophosphate, potassium pyrophosphate, disodium orthophosphate, dihydrate, trisodium orthophosphate, decahydrate, tetrasodium pyrophosphate, sodium tripolyphosphate, sodium phosphate glass; neutral soluble salts such as sodium sulfate and sodium chloride; silicates; organic sequestering agents; and anti-redeposition agents.

When carrying out the process of the instant invention, the protective encapsulate materials or coatings

of the invention are conveniently applied using fluidized bed encapsulating equipment. Such equipment comprises a coating chamber or cylindrical tower wherein the coating or encapsulation of the particles is accomplished. An  
5 unexpanded bed of the particles to be coated is introduced into the equipment. A nozzle constituting a spraying means is disposed within the equipment and adapted to be adjusted vertically so that the liquid coating material discharged in a downwardly diverging three-dimensional spray pattern  
10 would just cover the upper surface area of the bed.

The coating solution is contained in a vessel and is fed to the nozzle. Fluidizing gas (typically air) passes into the fluidized bed area. The fluidized gas is heated or cooled if required, in order to maintain the fluidizing  
15 gas within a desired temperature range.

A known weight of particles of a halogen source to be coated is placed in the equipment. Air is caused to flow into the fluidized bed thereby expanding the layer of particles, and maintaining the particles in continuous  
20 motion within the volume defined by the expanded bed, thus forming a fluidized bed. A solution of a coating substance is sprayed through the nozzle on the fluidized bed of particles until all particles in the bed are completely coated. Particles coated by the above-described procedure  
25 are completely encapsulated with a continuous coating, and are free-flowing and non-agglomerated.

It is important that each particle be fully covered to prevent the oxidizing halogen source from reacting in the deterrent system environment.

30 When it is desired to apply an initial coating of a coating agent and a subsequent coating of a synthetic detergent, the double coating may be conducted in a single fluidized bed either by applying the first coat, emptying the solution tank, filling the solution tank with the  
35 second coating solution and then applying the second coat; or with a dual coating solution inlet to the nozzle, the fluidized particles in the bed first being coated with the



coating agent contained in a solution tank, this first coating being allowed to dry and then a second coating of the synthetic detergent contained in a second solution tank being applied, both coatings being conducted in accordance with the previous discussion on the operation of the fluidized bed.

A third method of applying a double coating in a fluidized bed is to coat the core particles with the coating agent in a first fluidized bed apparatus. The coated material is then allowed to dry and placed in a second fluidized bed apparatus, wherein the encapsulated product produced in the first fluidized bed is coated with a second coating solution of a synthetic detergent. The fluidized bed operation is conducted in accordance with the prior discussion of the operation of the fluidized bed.

Before removal of the encapsulated oxidizing chlorine source from the fluidized bed the temperature in the bed can be increased so as to drive off any solvent remaining in the encapsulate. However, the temperature must remain below the melting temperature of the encapsulant and below the degradation temperature of the encapsulated core and coatings.

The encapsulated halogen bleach sources of the present invention comprise about 20 to 90 wt-% halogen bleach source core and about 10 to 80 wt-% coating when a single coating is utilized, and about 20 to 90 wt-% halogen bleach source core, about 0.5 to 50 wt-% inorganic coating agent first coat, and about 5 to 70 wt-% synthetic coating when a double coating is utilized.

More particularly, the single coated halogen bleach source comprises about 30 to 80 wt-% halogen bleach source core and about 20 to 70 wt-% synthetic coating and most particularly about 40 to 55 wt-% halogen bleach source core and 45 to 60 wt-% synthetic coating.

A more preferred embodiment of the double coated halogen bleach source comprises about 30 to 80 wt-% halogen bleach source core, about 5 to 50 wt-% inorganic coating

agent first coating, and about 5 to 50 wt-% synthetic coating. In a most preferred embodiment, the encapsulate comprises about 30 to 60 wt-% chlorine bleach source core, about 15 to 45 wt-% inorganic coating agent first coating, and about 10 to 35 wt-% detergent second coating.

#### Dispensing

The cast solid deterative systems of the invention can be dispensed from a manual or automatic dispenser in which a stream of water is contacted with a surface of the cast material providing a concentrate that is directed to a use location.

The cast material can be contained in a disposable container and inserted into the dispenser in that form. Alternatively the cast material can be manually removed from a disposable container directly into a dispenser wherein the stream of water is contacted with at least one surface of the material. Typical dispensers are mechanical apparatus containing a nozzle for directing a stream of water onto the solid cast material. The dispenser typically comprises a housing containing the internal working parts. The housing typically includes a storage portion wherein the mass of the solid block deterative system can be supported. The dispenser contains typically a support means upon which the cast material is placed. The support is typically horizontally mounted within the dispenser and maintains the block material in position adjacent to the spray. The preferred support comprises a screen mounted to the inner walls of the housing at a position fixed above the spray such that the spray contacts the majority of the solid cast deterative system. The spray-forming nozzle is connected to a pressurized source of water by means of a supply line. The spray is controlled by a device that can demand the addition of the concentrate made by spraying water on the cast material. Upon the receipt of demand, water flow is directed through the supply line and nozzle onto substantially the entire lower surface of the cast material at pressures typically

greater than 10 psi. Heated water can be used depending on the formulation. The use of heated water, all else being equal, increases the rate of dispensing. The deterative system passes in solution form through the support screen  
5 and is directed by underlying collector portion of the housing to an outlet port and through a conduit to a utilization point. The utilization point can be a warewashing machine, a station for charging containers such as buckets or other apparatus with a concentrate for  
10 dissolution with additional quantities of water, or other use positions.

Alternatively the dispensing apparatus can be manually operated such that a measured amount of concentrate can be produced by manually triggering the spray onto the cast  
15 material.

We have found that the stability of the chlorine source in the presence of the organic compositions relates to the quantity of free water in the cast material. We have found that the deterative systems during manufacture  
20 require some water for processing. Preferably all water present in the deterative system after casting is in the form of bound water or water of hydration or complexed water which is sequestered and removed from reactivity with the components. Free water is water available for reaction  
25 with the encapsulated chlorine material and can provide a medium of reaction between released chlorine and any organics present in the cast material. We have found that maintaining the concentration of free water below about 10 wt-% can aid in preserving the availability of chlorine in  
30 the cast material over a substantial period of time, preferably maintaining the concentration of free water at less than 5 wt-% or most preferably less than 2 wt-% can be very effective in maintaining the stability of the material.

35

#### Example I

##### Chlorinated General Purpose Cleaner

Into a stainless steel jacketed tank equipped with a

variable speed turbine agitator was charged 10 parts of soft water which was heated to 170° F. Into the mixed water was added 20 parts of a polyethylene glycol (CARBOWAX 8000, Union Carbide) at a sufficient rate to dissolve the CARBOWAX in the water. Agitation was ended and into the tank was placed 22 parts of a linear alkyl benzene sulfonate, 4 parts of a polyacrylic acid polymer (GOODRITE K-7058D, B. F. Goodrich), 14.5 parts of a powdered sodium tripolyphosphate, and 1 part of a granular sodium tripolyphosphate, 14 parts of anhydrous sodium metasilicate and 6 parts of sodium bicarbonate. The product was cooled to a temperature below 145° F. Next, 8.5 parts of an encapsulated sodium isocyanurate (of Example II) is added to the tank and the contents of the tank are carefully agitated at a temperature below 145° F. in a manner such that the encapsulate is evenly distributed throughout the product. The material is drawn from the tank and 2 lbs. of the warm liquid material is placed in polyethylene containers. The containers and their contents are cooled in an air chiller for 12-15 minutes at a temperature less than 10° F. and are solidified.

#### Example II

The encapsulated sodium dichloroisocyanurate used in Example I was prepared as follows. Into a cylindrical fluidized bed encapsulating machine was placed 61.25 parts of sodium dichloroisocyanurate. The particles were fluidized and suspended in air by an upwardly moving stream of air at a temperature of about 90° C. Onto the heated suspended particulate was sprayed a solution comprising in 68.97 parts of soft deionized water, 16.5 parts of sodium sulfate and 5.5 parts of sodium tripolyphosphate. The addition of this solution creates a first inorganic layer of mixed sodium sulfate and sodium tripolyphosphate. After the complete addition of the inorganic layer, a solution comprising 49.62 parts of a sodium linear alkyl sulfonate in 49.62 parts of soft water is then sprayed on the fluidized particle. This second step created an organic

encapsulate layer on the exterior of the particle. Substantially all free water (about 151.5 parts were removed) was removed during encapsulation.

#### Example III

5 A chlorinated solid laundry detergent was made according to the following procedure. Into a stainless steel mixing tank equipped with heating and cooling and a variable speed turbine agitator was placed 20 parts of a nonylphenol ethoxylate having an average of 9.5 mol:s of  
10 ethylene oxide, and 0.6 part of hexylene glycol. The mixer is begun and into the tank is charged 11.35 parts of a polyethylene glycol (CARBOWAX 8000, Union Carbide) at a rate such that the polyethylene glycol melts and dissolves in the liquid phase. In a separate container 2.3 parts of  
15 soft water, 0.1 part of a fluorescent brightener and 0.004 part of a blue dye were mixed and then charged to the tank. The temperature of the charged materials was permitted to fall below 150° F. In a separate dry blender 0.5 part of carboxymethyl cellulose, 27.246 parts of sodium  
20 tripolyphosphate powder and 9.4 parts of anhydrous sodium metasilicate were dry blended. The dry blend was slowly added to the liquid phase in the mixing tank. After uniformity was reached, 0.25 part of a fragrance was added. The mixture was cooled and to the carefully agitated  
25 mixture was added 19 parts of a chlorinated isocyanurate manufactured in Example IV with 5 parts of sodium carbonate. The agitation was controlled such that the encapsulate was just distributed throughout the product and terminated. The material was packaged in 4 lb. aliquots in  
30 polyethylene tubs and cooled until solid.

#### Example IV

Using the procedure of Example II the following encapsulate was prepared.

	<u>Ingredient</u>	<u>Parts by Weight</u>
	Core:	
	Sodium dichloroisocyanurate	63.2
	Coating 1:	
5	Sodium sulfate	25.8
	Sodium tripolyphosphate	8.6
	Soft water	103.0
	Coating 2:	
	Hydroxypropyl cellulose	4.9
10	Soft water	98.4
	Water removed during encapsulation	203.9

Example V

Using the procedure of Example II an encapsulated  
15 chlorine source was prepared using the following  
ingredients.

	<u>Ingredient</u>	<u>Parts by Weight</u>
	Core:	
20	Sodium dichloroisocyanurate	80.65
	Coating 1:	
	Sodium sulfate	14.73
	Sodium tripolyphosphate	4.33
	Soft water	58.68
25	Coating 2:	
	Carboxymethyl cellulose	5.00
	Soft water	88.80
	Water removed during encapsulation	351.27

30

Example VI

Using the procedure of Example II an encapsulated  
chlorine source was prepared using the following  
ingredients.

	<u>Ingredient</u>	<u>Parts by Weight</u>
	Core:	
	Sodium dichloroisocyanurate	63.2
	Sodium sulfate	25.8
5	Coating 1:	
	Sodium tripolyphosphate	8.6
	Soft water	103.0
	Coating 2:	
	Hydroxyethyl cellulose	4.9
10	Soft water	98.3
	Water removed during encapsulation	203.9

Example VII

15 An encapsulated chlorine source was prepared using the procedure of Example II using the following ingredients.

	<u>Ingredient</u>	<u>Parts by Weight</u>
	Core:	
	Sodium dichloroisocyanurate	63.2
20	Coating 1:	
	Sodium sulfate	25.8
	Sodium tripolyphosphate	8.6
	Soft water	103.0
	Coating 2:	
25	Methyl cellulose	4.92
	Soft water	245.92
	Water removed during encapsulation	351.46

Example VIII

30 A solid chlorinated fabric softening laundry detergent was prepared following the procedure of Example III using the following ingredients.

	<u>Ingredient</u>	<u>Parts by Weight</u>
	Nonylphenol ethoxylate	26.39
	with 9.5 moles ethylene oxide	
	Hexylene glycol	1.17
5	Polyethylene glycol	14.66
	Soft water	2.25
	Dye	0.08
	Sodium tripolyphosphate	26.39
	Sodium metasilicate	3.81
10	Quaternary ammonium fabric softener	2.25
	Encapsulate of Example VI	23.00

Example IX

Example VI was repeated with the encapsulate of  
15 Example II.

Example X

Example VIII was repeated with the encapsulate of  
Example V.

Example XI

20 Example VIII was repeated with the encapsulate of  
Example VII.

Table 1Active Chlorine Stability

25 Percent Active Chlorine Retained After  
Storage at 100° for Two Weeks

	<u>Preparation</u>	<u>Percent Retained</u>
	Example VIII	67.2
30	Example IX	57.5
	Example X	62.8
	Example XI	85.2

Example XII

35 Chlorinated General Purpose Cleaner

Into a stainless steel mix tank equipped with heating  
and cooling equipment and a variable speed turbine type



agitator was added 10 parts of water and 22 parts of polyethylene glycol (CARBOWAX 8000). The glycol was added at a rate such that it was melted and fully mixed upon addition. Into the heated solution was added 20 parts of a linear alkyl sulfonate, 4 parts of a polyacrylate polymer, 15.5 parts of sodium tripolyphosphate, 14.0 parts of sodium metasilicate, and 6 parts of sodium bicarbonate. The contents of the mixer were agitated until uniform and into the mixer was added 8.5 parts of the encapsulate of Example II. The contents of the mixer were carefully agitated until just uniform. The material manufactured above had a chlorine stability of 106.06% chlorine retained at 100° F. for two weeks of storage.

15

Table 2Dispensing Characteristics of Product of Example XII

		Grams Dispensed	
		(Average of 5 Tests)	
	<u>Temperature</u>	<u>At 30 psi</u>	<u>At 50 psi</u>
20	120°	34.338	53.735
	130°	38.72	59.2
	140°	50.68	66.184
	150°	55.44	81.7

25 The data in Table 2 shows that the product of Example XII is easily dispensed using warm water at commonly available temperatures at commonly available pressures at most end use sites. The product can easily be dispensed for any typical end use by controlling either pressure, temperature  
30 or dispensing time.

The product was dispensed by placing the material in a dispenser using a 30-second cycle at either 30 or 50 psi and at temperatures ranging from 120-150° F.

A useful dispenser is shown in FIGURE 1. Referring to  
35 Fig. 1, there is generally disclosed a dispenser having a container or housing 20. The housing has a generally cylindrical upper storage portion 21 having a cylindrical

inner wall 22. The wall 22 defines an internal cavity 23. The upper terminous of the storage portion 21 defines an access port 24 into cavity 23 of storage portion 21.

Inner wall 22 of housing 20 converges in the downward  
5 direction, defining a lower funnel-shaped collector portion 25 of housing 20. Inner wall 22 of housing 20 is configured to form an annular flange at 26 circumferentially extending around inner wall 22 of housing 20 at the juncture of upper storage portion 21 and lower  
10 collector portion 25. The lower terminous of collector portion 25 defines an outlet port 27 from internal cavity 23 for passage therethrough of solution collected by collector portion 25. Outlet port 27 has a hose clamp extension 28 having a plurality of annular ribs configured  
15 for engaging the inner walls of a connecting hose or conduit 29.

The outlet port 27 may be directly connected with the wash chemical solution utilization point by conduit 29 and feed thereto by gravity as it is created or feed thereto by  
20 a wash chemical solution pump 30 placed in conduit 29.

Housing 20 may be constructed of any suitable material which is capable of withstanding exposure to cleaning solutions, and is preferably configured of stainless steel or molded plastic material. The housing 20 can be  
25 constructed of a transparent or translucent material to allow the operator to see at a glance the amount of wash chemical in storage portion 21 and if dispenser 20 needs to be refilled. If housing 20 is not made of a transparent or translucent material, preferably a portion of storage  
30 portion 21 is made transparent or translucent to aid in determining when dispenser 20 should be refilled. A pair of mounting plates 32 are connected to and extend rearwardly from the outer surface of housing 20 for securely mounting housing 20 to a vertical side wall.

35 A door 34 is sized to extend entirely across and to sealingly close access port 24. Door 34 is pivotally mounted at 35 for pivotal motion between a closed and

opened position. The lower collector portion 25 of housing 20 has an outwardly projecting coupling portion 36 extending from collector portion 25 adjacent outlet port 27 of collector portion 25. A tube fitting insert 37 is  
5 secured within coupling projection 36 and projects through inner wall 22 of collector portion 25 of housing 20. A spray-forming nozzle 38 is threaded into the end of tube insert 37 and is axially aligned within inner cavity 23 of housing 20 in a direction so as to direct an upwardly  
10 projected spray pattern therefrom. Tube fitting insert 37 is provided with an O-ring seal 39.

A horizontal support screen 40 is mounted in resting engagement upon annular flanged portion 26 of housing 20. Support screen 40 has about 1 inch square openings in order  
15 to support a solid block of deterative system 80 without significantly interfering with the impingement of water sprayed from nozzle 38 onto the lower surface of water sprayed from nozzle 38 onto the lower surface 81 of the deterative system 80 (i.e., the surface in contact with  
20 support screen 40).

A 1/4 to 1/20 inch (0.63 to 0.13 cm) lower screen 41 is placed in collector portion 25 of housing 20 between spray nozzle 38 and outlet port 27 to catch any undissolved  
25 chunks of wash chemical 80 small enough to pass through support screen 40. This prevents small chunks of chemical 80 collecting in outlet port 27 or conduit 29 and blocking the flow of concentrated wash chemical solution out of dispenser 20.

A water supply inlet pipe 42 is connected to tube  
30 insert 37 and is in communication therewith for providing a source of water flow to spray-forming nozzle 38. Water supply line 42 passes through one of the mounting plate members 32 and receives structural support therefrom. A siphon breaker 43 interrupts water supply line 42. A  
35 safety switch 50 is mounted to door 34 for movement therewith and senses the operative position of door 34 relative to access port 24 of housing 20. In the preferred

embodiment, safety switch 50 comprises a mercury actuated switch.

FIGURES 2 and 3 represent an embodiment of the product format for the cast deterative systems of the invention.

5 The solid cast deterative system of the invention is packaged in a closable container 200 which comprises a lid 210 and a lower container section 211. The lid 210 can be made of a variety of materials including paper, film, foil, etc. The lower container can also be made of a variety of  
10 materials, however thermoplastic deformable material is preferred. The lid 210 is adhered to the container 211 through a releasable layer 212 disposed between the lid and the container.

FIGURE 3 shows a side view of the cast deterative  
15 system within its container. In use lid 210 is peeled from the top of the lower portion revealing the upper surface of the cast material 80. The container as a whole without the lid can be inserted into the dispenser. Alternatively the container body 211 if made of a deformable material can be  
20 flexed for the purpose of removing the cast material 80 in a solid block which can then directly be inserted into the dispenser for contact with a water stream.

While the foregoing discussion, Examples and data provide a basis to understand the invention, many  
25 embodiments of the invention can be made without departing from the spirit and scope of the invention. Thus the invention resides in the claims hereinafter appended.

## WHAT IS CLAIMED IS:

1. A solid cast, active halogen-containing, storage-stable, deterative system comprising:

5 (a) an effective deterative amount of a source of alkalinity;

(b) an effective amount of a hardness sequestering agent;

(c) about 5 to 60 wt-% of an encapsulated source of active halogen; and

10 (d) about 5 to 50 wt-% of a polyalkylene oxide polymer;

wherein, in the cast composition, the halogen available from the source of active halogen is storage stable in the presence of the polyalkylene oxide polymeric composition.

15 2. The deterative system of claim 1 wherein the halogen is chlorine.

3. The deterative system of claim 2 wherein there is 15 to 30 wt-% of the encapsulated source of active chlorine.

20 4. The deterative system of claim 2 wherein there is 15 to 50 wt-% of the encapsulated source of active chlorine.

5. The deterative system of claim 2 wherein there is 20 to 35 wt-% of the source of encapsulated active  
25 chlorine.

6. The deterative system of claim 2 wherein the encapsulate comprises 1 to 80 wt-% of a source of active chlorine and 99 to 20 wt-% of an encapsulating layer.

7. The deterative system of claim 6 wherein the  
30 encapsulating layer comprises a synthetic anionic surfactant.

8. The deterative system of claim 6 wherein the encapsulating layer comprises 10 to 90 wt-% of a first inorganic layer and 90 to 10 wt-% of a second organic  
35 layer.

9. The deterative system of claim 8 wherein the organic encapsulating layer comprises a cellulosic layer, a

synthetic anionic surfactant or mixtures thereof.

10. The deterative system of claim 9 wherein the cellulosic layer comprises methyl cellulose, a hydroxyalkyl cellulose, or mixtures thereof.

5 11. The deterative system of claim 2 wherein the source of active chlorine is selected from the group consisting of trichloroisocyanuric acid, potassium dichloroisocyanurate, sodium dichloroisocyanurate, sodium dichloroisocyanurate dihydrate, and mixtures thereof.

10 12. The deterative system of claim 1 wherein the polyalkylene oxide polymeric composition comprises a polyethylene oxide polymer, a polypropylene oxide polymer, or an ethylene oxide/propylene oxide block copolymer.

13. The deterative system of claim 12 wherein the  
15 alkylene oxide polymer comprises a nonionic surfactant.

14. The deterative system of claim 13 wherein the nonionic surfactant comprises a block copolymer containing at least one ethylene oxide block and at least one propylene oxide block.

20 15. The deterative system of claim 14 wherein the nonionic surfactant comprises an alkyl phenol alkoxylate wherein the alkyl group is a  $C_{1-12}$  alkyl and the alkoxylate comprises 2 to 24 moles of ethylene oxide.

25 16. The deterative system of claim 1 wherein the hardness sequestering agent comprises an organic hardness sequestering agent or an inorganic hardness sequestering agent.

30 17. The deterative system of claim 16 wherein the organic hardness sequestering agent comprises a polyacrylic acid, an organic phosphonate, or mixtures thereof.

18. The deterative system of claim 16 wherein the inorganic hardness sequestering agent comprises a condensed phosphate hardness sequestering agent.

35 19. The deterative system of claim 18 wherein the condensed phosphate comprises an alkali metal tripolyphosphate sequestering agent.

20. The deterative system of claim 1 wherein the

source of alkalinity comprises an alkali metal hydroxide or an alkali metal silicate having an  $M_2O:SiO_2$  ratio of about 2:1 to 1:3.6 wherein M is an alkali metal.

21. The deterative system of claim 1 wherein the  
5 source of alkalinity comprises an alkali metal carbonate, an alkali metal bicarbonate, an alkali metal borate and mixtures thereof.

22. The deterative system of claim 1 which additionally comprises an anionic surfactant.

10 23. The deterative system of claim 22 wherein the anionic surfactant comprises an alkyl sulfonate, an alkyl sulfate, an alkyl benzene sulfonate, an alkyl benzene sulfate, or mixtures thereof.

24. A solid, cast, stable, chlorine-containing  
15 laundry detergent comprising:

(a) about 0.1 to 50 wt-% of a soil-removing nonionic surfactant;

(b) about 0.1 to 95 wt-% of a source of alkalinity;

20 (c) an effective amount of a hardness sequestering agent;

(d) about 5 to 60 wt-% of an encapsulated chlorinated isocyanurate compound; and

25 (e) about 5 to 50 wt-% of a polyalkylene glycol casting agent;

wherein, in the cast laundry detergent composition, the available chlorine is storage stable in the presence of the nonionic surfactant and the polyalkylene glycol casting agent.

30 25. The detergent of claim 24 wherein there is 15 to 30 wt-% of the encapsulated source of active chlorine.

26. The detergent of claim 24 wherein there is 20 to 25 wt-% of the source of encapsulated active chlorine.

27. The detergent of claim 24 wherein the encapsulate  
35 comprises 1 to 80 wt-% of a source of active chlorine and 99 to 20 wt-% of an encapsulating layer.

28. The detergent of claim 27 wherein the

encapsulating layer comprises a synthetic anionic surfactant.

29. The detergent of claim 27 wherein the encapsulating layer comprises 10 to 90 wt-% of a first  
5 inorganic layer and 90 to 10 wt-% of a second layer comprising an organic encapsulating layer.

30. The detergent of claim 29 wherein the organic encapsulating layer comprises a cellulosic layer, a synthetic anionic surfactant or mixtures thereof.

10 31. The detergent of claim 30 wherein the cellulosic layer comprises methyl cellulose, a hydroxyalkyl cellulose, or mixtures thereof.

32. The laundry detergent of claim 24 wherein the detergent additionally comprises an effective amount of a  
15 soil anti-redeposition agent.

33. The detergent of claim 32 wherein the soil anti-redeposition agent comprises a carboxymethyl cellulose composition.

34. The detergent of claim 24 wherein the detergent  
20 additionally comprises a dye, a perfume, an anti-redeposition agent, a brightener or mixtures thereof.

35. The detergent of claim 24 wherein the chlorinated isocyanurate compound is selected from the group consisting of trichloroisocyanuric acid, potassium dichloroisocyanurate, sodium dichloro isocyanurate, sodium dichloro  
25 isocyanurate dihydrate, and mixtures thereof.

36. The detergent of claim 35 wherein the nonionic surfactant comprises a block copolymer containing at least one ethylene oxide block and at least one propylene oxide  
30 block.

37. The detergent of claim 36 wherein the nonionic surfactant comprises an alkyl phenol alkoxylate wherein the alkyl group is a C<sub>1-12</sub> alkyl and the alkoxylate comprises 2 to 24 moles of ethylene oxide.

38. The detergent of claim 24 wherein the hardness sequestering agent comprises an organic hardness sequestering agent or an inorganic hardness sequestering



agent.

39. The detergent of claim 38 wherein the organic hardness sequestering agent comprises a polyacrylic acid, an organic phosphonate, or mixtures thereof.

5 40. The detergent of claim 38 wherein the inorganic hardness sequestering agent comprises a condensed phosphate hardness sequestering agent.

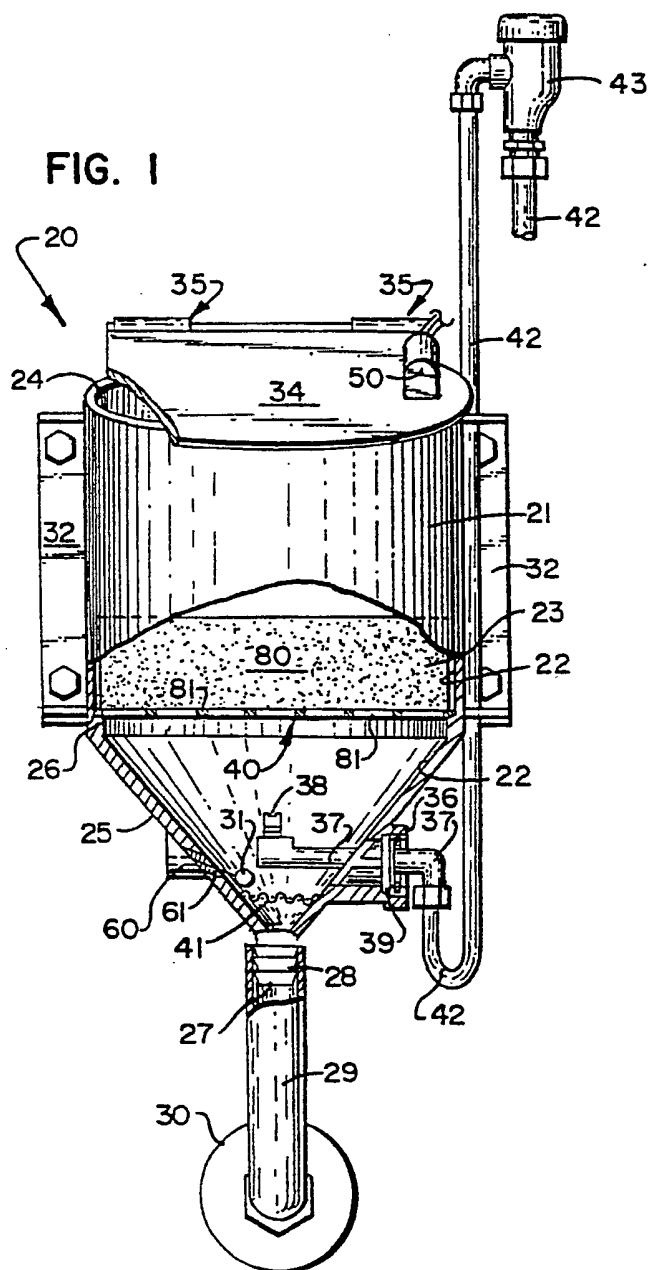
41. The detergent of claim 40 wherein the condensed phosphate comprises an alkali metal tripolyphosphate  
10 sequestering agent, an alkali metal carbonate, an alkyl metal bicarbonate, and mixtures thereof.

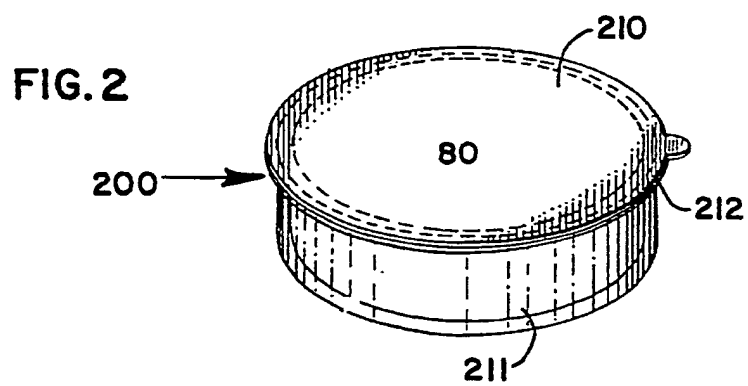
42. The detergent of claim 24 wherein the source of alkalinity comprises an alkali metal hydroxide or an alkali metal silicate having an  $M_2O:SiO_2$  ratio of about 2:1 to  
15 1:3.6 wherein M is an alkali metal.

43. The detergent of claim 24 which additionally comprises an anionic surfactant.

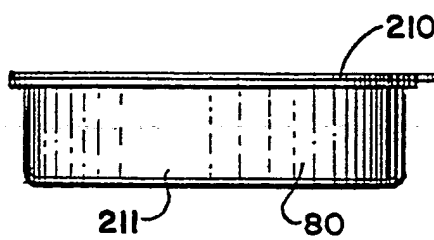
44. The detergent of claim 24 which additionally comprises a quaternary fabric softener.

FIG. 1





**FIG. 3**



# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 89/03313

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC IPC <sup>5</sup> : C 11 D 3/395, C 11 D 17/00, C 11 D 3/37		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
IPC <sup>5</sup>	C 11 D	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b>		
Category <sup>9</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
X	EP, A, 0307587 (ECOLAB INC.) 22 March 1989 see page 6, lines 13-45; examples and claims	1-43
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A	EP, A, 0003769 (ECONOMICS LAB.) 5 September 1979 see claims	1
--		
A	EP, A, 0264043 (HENKEL) 20 April 1988 see claims	1
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A	US, A, 3637509 (W.R. BRENNAN) 25 January 1972 see claims	1
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A	US, A, 4136052 (L.R. MAZZOLA) 23 January 1979 see claims	1
--		
A	EP, A, 0298222 (ECOLAB INC.) 11 January 1989	1
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><sup>10</sup> Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p> </div> </div>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
10th October 1989		10 NOV. 1989
International Searching Authority		Signature of Authorized Officer
EUROPEAN PATENT OFFICE		T.K. WILLIS

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
	see claims -----	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.**

US 8903313  
SA 30516

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 02/11/89  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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